THE ERUPTION OF YAKE-DAKE, JAPAN, IN 1915

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The "festoon islands" of Japan form a portion of the girdle of volcanoes which encircles the Pacific. Of the 165 volcanoes which have been found in Japan, 54 are classed as active. These volcanoes can be grouped into a number of volcanic lines, of which the one stretching from Fuji-yama southward through the Bonin Islands is one of the most conspicuous. It is on this line, north of Fuji-yama (Fig. 1), that Yake-dake is situated, in the midst of the Japanese Alps, a granite range of mountains 7,000 to 10,000 feet in height. Within ten miles of Yake-dake there are two quiescent volcanoes, Norikura-dake and Kasa-dake.

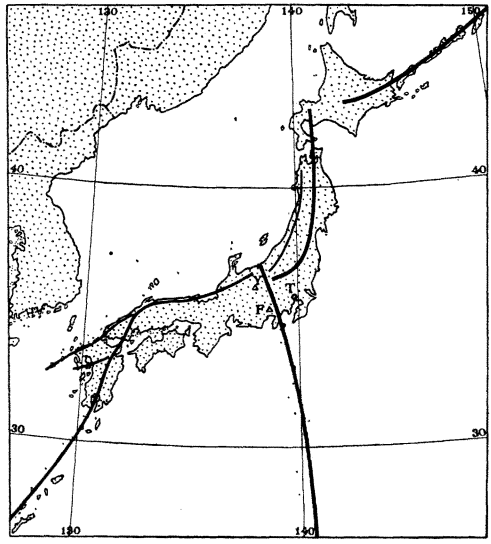

FIG. 1—Outline map of Japan showing the position of Yake-dake (Y) with respect to Tokyo (T) and Fuji-yama (F). Scale, 1:32,000,000. The principal volcanic lines are shown, based on a map in Ishizu's "The Mineral Springs of Japan," Tokyo, 1915 (see March *Review*, p. 239).

An eruption of Yake-dake, accompanied by a fall of ash over the surrounding region and a mud-flow, partly blocking the Azusagawa River, took place on June 6, 1915. In August the writer visited the mountain during a trip to the Orient for the purpose of studying volcanoes and was able to gather the following information concerning the eruption.

Yake-dake is 125 miles northwest of Tokyo and is reached from the city of Matsumoto, 150 miles from Tokyo by rail. From Matsumoto a wagon called a *basha,* a sort of springless "one-horse shay," is taken for 13 miles to a settlement called Shimashima, and from there it is necessary to walk with one's "boy" (interpreter) over the Tokugo Pass of 7,000 feet elevation into the valley of the Azusagawa River to a small inn at Kami-kochi, a distance of about 19 miles. This inn is situated near a hot spring at an elevation of 4,900 feet in a V-shaped valley where snow persists in large quantities in the ravines throughout the year.[1]

From Kami-kochi the volcano, rising to a height of 8,000 feet, is three

[1] This general region has been described by the Rev. Walter Weston in an article entitled "Exploration in the Northern Japanese Alps," *Geogr. Journ.*, Vol. 46, 1915 (Sept.), pp. 188-200.

miles away. It is a steep-sided mountain with a rounded top, composed of coarse-grained andesite. Smoke issues from the crater near the summit and from the newly opened crater on the east side. There are two summits, each composed of massive andesite, and between them are two craters, one of which is quiescent, the other emitting steam in large quantities. The recent eruption as witnessed from Kami-kochi is described by J. M. Davis as follows:

Earthquake shocks with increasing intensity were felt at 7 o'clock on the morning of June 6. A strong concussion was felt as the volcano was split open on the east side from the base to within 1,000 feet of the top. The explosions hurled out rocks, ashes, mud, steam, and smoke with a tremendous reverberation of sounds, as the massive granite cliffs on the opposite side of the valley are only a mile away. Ashes fell at Kami-kochi, and the whole valley was enshrouded in a heavy cloud of smoke. The activity continued all day with frequent earthquake shocks, the roar of escaping steam, and the crash of falling trees and rocks. A row of new craters was opened along the new fissure, the principal crater being at an elevation of 7,000 feet. The ash and mud broke all the branches of the trees in the neighborhood, and a large mass of mud and boulders slid down the steep slope into the valley below, damming the stream.

Toward evening of the first day a heavy rain began to fall and continued all the next day. Minor explosions from the craters continued also throughout the second day, and more landslides took place. No further information is available, as it was quite impossible for the writer to secure satisfactory information from the natives about this or any other Japanese volcano, partly because the interpreters were not familiar with volcanic activity, but principally because the natives have no interest in volcanoes, even those near by.

An examination of the mountain in August showed a row of small craters at the upper end of the newly formed fissure. These craters were arranged along the fissure, with several small pits in each depression. With the exception of those in the uppermost crater, the pits were inactive, and many were filled with water. The upper crater was about 100 feet long and 30 feet wide at the base, with a wall toward the mountain rising 300 feet and a ridge on the lower side between this and the next crater 70 feet high. Steam was rushing with a hissing sound from a hole ten feet in diameter in the upper crater and sweeping up toward the top of the mountain as seen in Figure 2. The sides of the craters and the surrounding region were covered with gray mud, which was at least three feet thick at the upper crater. The trees on the sides of the mountain were all killed, but some of them were killed by an eruption "about 28 years ago." A quarter of a mile below the main crater, the ash covering the fissures running down the mountain was one foot thick, and at the Kami-kochi inn it was one-eighth of an inch thick. Steam was issuing in many places from the fissures below the summit crater.

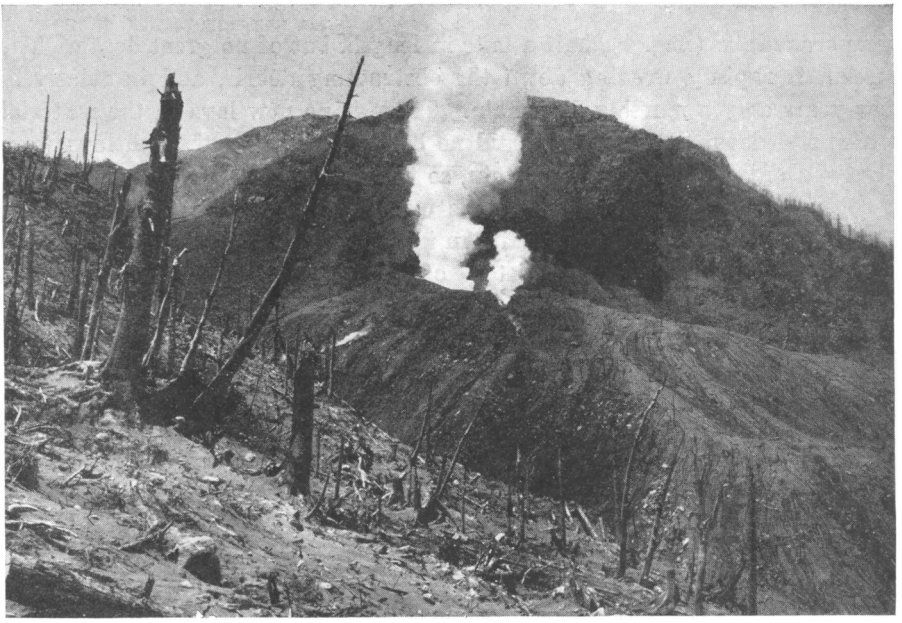

FIG. 2.

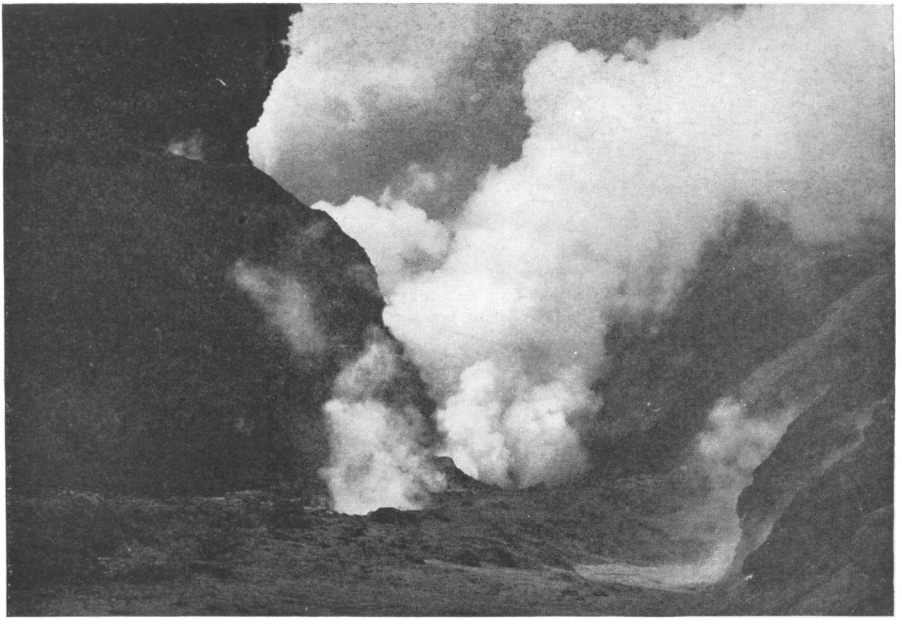

FIG. 3.

FIG. 2—The new crater of Yake-Dake, looking toward the summit of the mountain. The steam comes out of a hole about ten feet in diameter. The mud-flow which dammed the Azusagawa River started from the slope on the right.

FIG. 3—The main crater shown in Fig. 2, taken from the base of the newly opened fissure which extends down the mountain.

The damming of the Azusagawa River by a mud-flow has formed a temporary lake (Fig. 4), half a mile in length, but of no great depth. The stream is rapidly wearing down the obstructing débris, and in relatively few years only a marsh will remain. There is no new lava in the material which slid down the mountain, and no bombs indicative of fresh lava were observed anywhere on the mountain, so the eruption may represent merely a series of steam explosions such as caused the destruction of the mass Ko-Bandai of the volcano Bandai San in 1888.

In regard to the previous history of the volcano, Milne[2] reports that it was active in 1875, but the Japanese students at Kami-kochi know of only

FIG. 4—The new lake formed by a mud-flow damming the Azusagawa River. The mountain in the distance is Hodaka-dake, and near its base is the hot spring and inn Kami-kochi. The snow remains in these valleys all summer, for the elevation of the lake is about 4,900 feet and the top of Hodaka-dake is 10,250 feet.

two previous eruptions, one between 28 and 33 years ago, in which the steaming crater at the summit of the mountain was formed, and the other about 100 years ago, in which the extinct crater at the summit was blown out. The original form of the mountain is not easy to determine on account of the extensive erosion which has taken place. There appear to be solid masses of andesite at the two summits, which are now separated by two craters, and, if these masses were originally continuous, the form would suggest a volcanic dome similar to O-Usu at the volcano Usu-dake in Hokkaido (Yezo). The summits of the other Japanese volcanoes visited differ from Yake-dake in being composed principally of ash lapilli and bombs.

[2] John Milne: The Volcanoes of Japan, *Trans. Seismol. Soc. Japan*, Vol. 60, 1886.